

PCTWORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : B23F 15/08, F01C 21/08 F04C 18/16	A1	(11) International Publication Number: WO 93/04811 (43) International Publication Date: 18 March 1993 (18.03.93)
---	-----------	---

(21) International Application Number: **PCT/SE92/00578**
(22) International Filing Date: **24 August 1992 (24.08.92)**
(30) Priority data:
9102530-4 **3 September 1991 (03.09.91)** **SE**

(71) Applicant: **OPCON AUTOROTOR AB [SE/SE]; Värmdö-
vägen 120, S-131 60 Nacka (SE).**

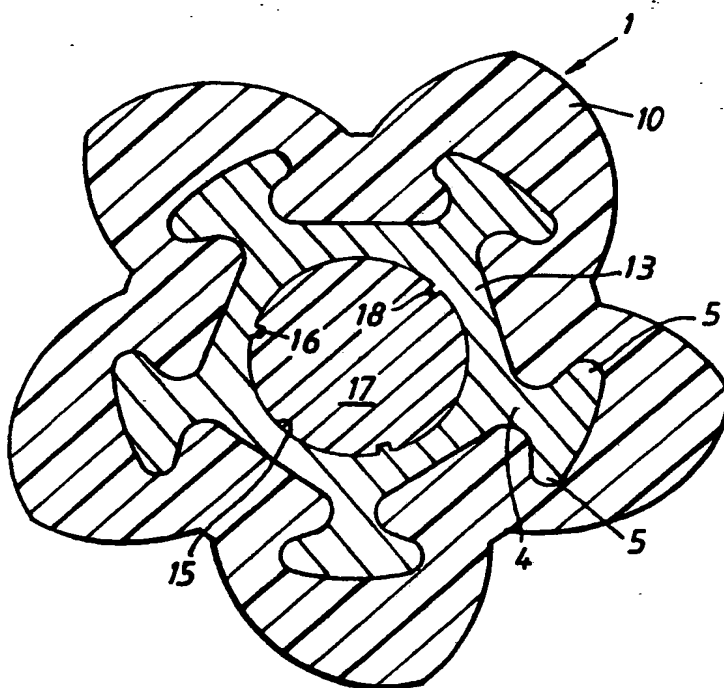
(72) Inventor: **WICÉN, Jan ; Utövägen 21, S-132 30 Saltsjö Boo
(SE).**

(74) Agents: **KARLSSON, Leif et al.; P.O. Box 15085, S-104 65
Stockholm (SE).**

(81) Designated States: **JP, European patent (AT, BE, CH, DE,
DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, SE).**

Published
With international search report.

(54) Title: **ROTOR FOR A SCREW ROTOR MACHINE**



(57) Abstract

A rotor for a screw rotor machine, which rotor comprises a metal shaft (3, 13) and a rotor body (1) of plastics material moulded on and around the shaft, which is provided with a number of radially and helically extending projections (4) with equal distribution around the shaft, which projections (4) are provided with essentially peripherally and helically extending wings (5) of considerable width originating from the ridge of the projections (4).

- 1 -

ROTOR FOR A SCREW ROTOR MACHINE.

5

The present invention relates to a rotor for a screw rotor machine of the kind described in the introduction of the following claim 1.

- 10 On rotors of this type, with a rotor body of plastics material moulded on a shaft, the shaft is prevented from being twisted off from the rotor body by the shaft being provided with radially protruding projections distributed in equal partition around the shaft. For especially female rotors it is thereby suitable to design the projections as helical, radial flanges with the same pitch as the lands of the rotor body, in which the flanges extend a short distance into the
- 15 central part of the lands. At high rpm it has turned out that the rotor bodies in spite of these measures are inclined to be broken off or separate from the shaft and its projections.

The object of the invention is to bring about an additional reinforcement of the rotor body's adhesion to the shaft and its projections.

20

This has, according to the invention, been achieved by giving the shaft's projections the characteristic features set forth in claim 1. Additional suitable embodiments have the characteristic features set forth in claims 2 to 4.

- 25 By means of the peripherally directed wings of the projections a major part of the tensile force is relieved, which otherwise at the rotation of the rotor would arise at the surface of the rotor shaft due to the mass of the part of the rotor body positioned radially outside the shaft. The wings shall suitably be placed as distant as possible from the surface of the shaft. If the shrinking of the projections can be arranged to exceed the shrinking of the plastics material
- 30 during the rotor's cooling at the manufacturing, even compression of the plastics material radially inside the wings might be achieved.

- The projections and wings belonging to them can be designed in several ways in order to support the adhesion of the rotor body to the shaft. Especially simple and efficient even from
- 35 a manufacturing point of view is to let each projection be equipped with two in opposite directions extending, similar wings, originating from the projection's ridge. In this case these should be extending without disruption between the rotor's ends, and one can easily and cheaply produce the shaft with projections and wings in an extruding operation. This is

suitably done by using a suitable light metal. If the shaft's rigidity has to be reinforced a tubular shaft can be extruded which then is pressed onto a steel shaft. At the extruding operation the projections and the wings can be given a helical design with the same pitch as the intended lands of the rotor body. A male rotor should in that case have as many lands as
5 projections, at which each projection should extend a bit into the central part of the corresponding land, where the wings have the largest tensile force reducing effect.

The invention will now be described in more detail in the following with reference to the accompanying drawings, which show different examples of embodiments of rotors according
10 to the invention and on which Figures 1 and 2, respectively, are perspective views of respectively a female and a male rotor, Figures 3 and 4 are cross section views of the rotors shown in Figures 1 and 2 and Figure 5 is a cross section view of a male rotor according to a preferred embodiment.

15 Figures 1 and 3 show a female rotor with a rotor body 1 moulded of a plastics material on a metal core 2 in a manner known per se. The metal core comprises a circular shaft 3 provided with a number of radial projections or flanges 4, extending along almost the whole length of the rotor body. Along the outer edge line of each flange 4 are extending two in opposite
20 directions directed, peripheral wings 5.

The rotor body 1 has a circular cylindrical part 6, coaxial with the shaft 3 from which part the helically designed lands 7 extend.

The metal core 2 is extruded with helically designed continuous flanges 4 and wings 5, at
25 which by symmetrical reasons a flange 4 is arranged in the line with each land 7. The flanges 4 with the wings 5 can also have another location with respect to the lands 7 and another number, and they can also be straight.

The male rotor shown in Figures 2 and 4, however, must have the same number of flanges 4
30 as the number of lands 10 and be helically designed together with the wings 5 in the central parts of the lands 10. Possibly every flange 4 may be equipped with an additional pair of wings 11. The mass of the lands 10 is considerably larger than the mass of the female rotor's lands 7, which makes the invention first of all intended for male rotors.

35 The presented preferred embodiment shown in Figure 5 is a male rotor with five lands 10. It has a shaft 13 with a mainly pentagonal cross section. The flanges of the shaft 13, are strongly dimensioned and have strongly dimensioned wings 5 with smooth transition sections between wings 5 and flanges 4 as well between flanges 4 and shaft 13.

The dimensioning of the wings 5 is chosen such that the same tensile stress is caused in the plastics material at the rotation of the rotor.

- 5 The metal core 13, 4, 5 is extruded from an aluminium alloy and cut to the right length, then the ends are turned down to form the shaft ends 3. After that the rotor body has been moulded on the metal core and axially somewhat in excess of the core, such that only the shaft ends 3 of the metal core are visible.
- 10 It is, as mentioned before, essential that the wings 5 are placed in the central parts of the lands 10 in order to as much as possible reduce the tensile stresses in the plastics material along the surface of the metal core 13, 4, 5.

- 15 In the embodiment shown in Fig. 5 an increased bending strength has been achieved by the metal core 13, 4, 5 being extruded in the shape of a hollow body. A circular cylindrical hole 15 with a number of inwardly directed, straight lands or splines 16 have been formed, into which hole a steel shaft 17 provided with a number of grooves 18 corresponding to the lands 16 has been pressed.

CLAIMS

- 5 1. A rotor for a screw rotor machine, the rotor having a number of helically extending lands (10) and intermediate grooves forming a working face of the rotor, the rotor comprising:
a shaft member (13);
a rotor body (1) made of plastics material molded on and around the shaft member
10 (13) so as to adhere to the surface of the shaft member (13), said rotor body made of plastics material defining said lands such that said lands are substantially made of plastics material; and
a plurality of radially directed projections (4) extending from the shaft member (13) with substantially equal distribution around the shaft member (13);
15 said projections (4) being integrally formed as one piece with the shaft member (13) characterized in that said projections (4) extend helically around the surface of the shaft member (13) with the same pitch as the lands (10), said projections (4) each being associated with and in registration with a respective corresponding land (10);
and
20 said projections (4) further having helically extending substantially peripherally directed wings (5) of considerable peripheral width with smoothly rounded edges, said wings (5) being integrally formed as one piece with said projections (4), said wings (5) being located substantially in the central line of the corresponding land (10) and being dimensioned to relieve during rotation of the rotor a major part of tensile
25 stresses acting on the plastics material of said rotor body (1) adhering to the surface of the shaft member (13).
2. The rotor of claim 1, characterized in that each of said radially directed projections (4) has two oppositely directed peripherally extending wings (5) originating from an end
30 portion thereof.
3. The rotor of claim 1 or 2, characterized in that said radially directed projections (4) and said wings (5) extend with substantially no disruption along the length of the rotor between respective ends of the rotor.
- 35 4. The rotor of claim 1, 2 or 3, characterized in that said shaft member (13), said projections (4) and said wings (5) comprise a single extrusion of metal material, preferably a light metal alloy.

1/2

Fig. 1

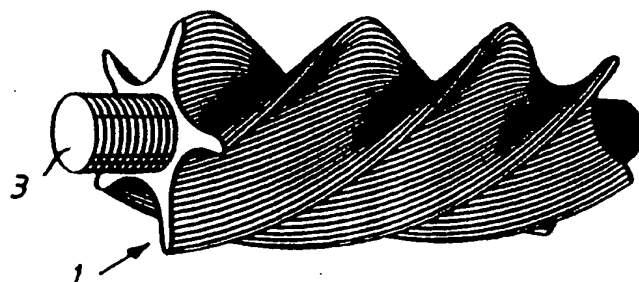


Fig. 2

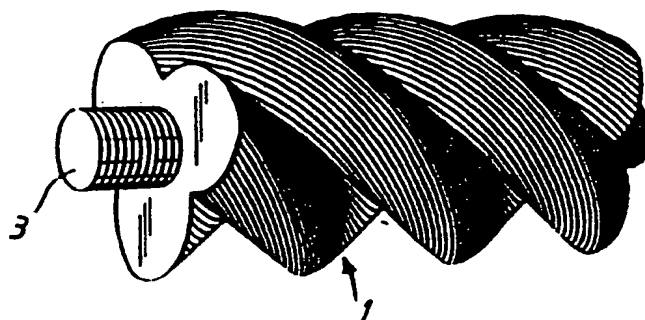


Fig. 3

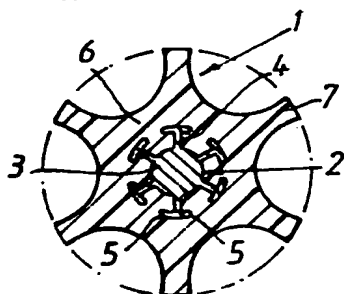
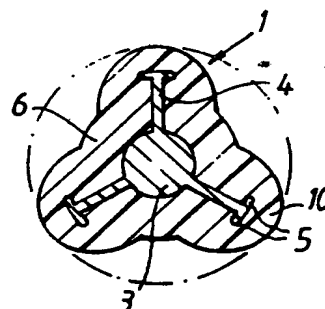
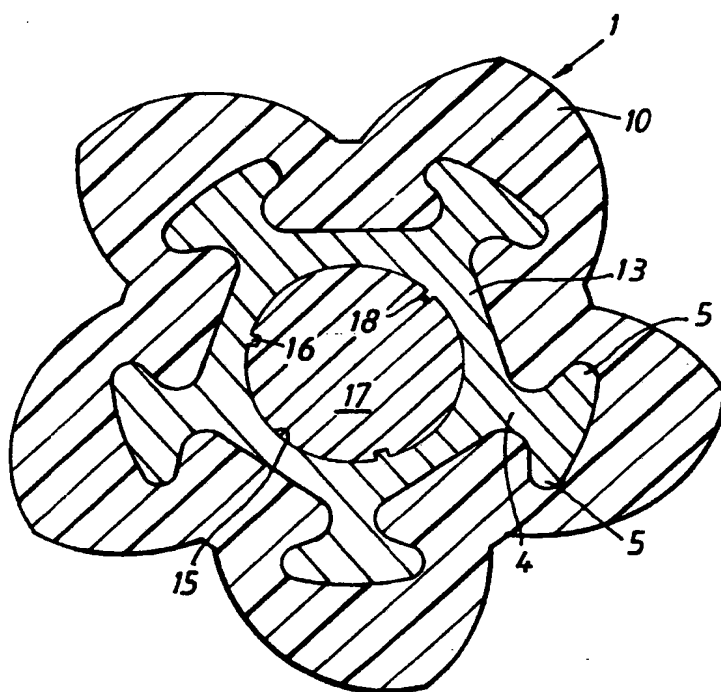


Fig. 4



2/2

Fig. 5



INTERNATIONAL SEARCH REPORT

International Application No **PCT/SE 92/00578**

I. CLASSIFICATION F SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: B23F 15/08, F01C 21/08, F04C 18/16														
II. FIELDS SEARCHED <div style="text-align: center;">Minimum Documentation Searched⁷</div> <table style="width: 100%; border: none;"> <tr> <td style="width: 20%; border: none;">Classification System</td> <td style="border: none;">Classification Symbols</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">IPC5</td> <td style="border: 1px solid black; padding: 5px;">B23F; F01C; F04C</td> </tr> </table> <div style="text-align: center; padding-top: 5px;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched⁸</div>			Classification System	Classification Symbols	IPC5	B23F; F01C; F04C								
Classification System	Classification Symbols													
IPC5	B23F; F01C; F04C													
SE,DK,FI,NO classes as above														
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Category *</th> <th style="width: 70%;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 20%;">Relevant to Claim No.¹³</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>DE, A1, 3621178 (WANKEL GMBH) 7 January 1988, see the whole document ---</td> <td style="text-align: center; vertical-align: top;">1</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>US, A, 4761124 (K. TIMUSKA ET AL) 2 August 1988, see the whole document ---</td> <td style="text-align: center; vertical-align: top;">1</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>US, A, 4846642 (R. NUBER ET AL) 11 July 1989, see the whole document -----</td> <td style="text-align: center; vertical-align: top;">1</td> </tr> </tbody> </table>			Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	A	DE, A1, 3621178 (WANKEL GMBH) 7 January 1988, see the whole document ---	1	A	US, A, 4761124 (K. TIMUSKA ET AL) 2 August 1988, see the whole document ---	1	A	US, A, 4846642 (R. NUBER ET AL) 11 July 1989, see the whole document -----	1
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³												
A	DE, A1, 3621178 (WANKEL GMBH) 7 January 1988, see the whole document ---	1												
A	US, A, 4761124 (K. TIMUSKA ET AL) 2 August 1988, see the whole document ---	1												
A	US, A, 4846642 (R. NUBER ET AL) 11 July 1989, see the whole document -----	1												
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents:¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>														
IV. CERTIFICATION <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; border: none;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">9th December 1992</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">15 -12- 1992</td> </tr> <tr> <td style="border: none;">International Searching Authority</td> <td style="border: none;">Signature of Authorized Officer</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px; text-align: center;">SWEDISH PATENT OFFICE</td> <td style="border: 1px solid black; padding: 5px;">Lena Nilsson</td> </tr> </table>			Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	9th December 1992	15 -12- 1992	International Searching Authority	Signature of Authorized Officer	SWEDISH PATENT OFFICE	Lena Nilsson				
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report													
9th December 1992	15 -12- 1992													
International Searching Authority	Signature of Authorized Officer													
SWEDISH PATENT OFFICE	Lena Nilsson													

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. PCT/SE 92/00578**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 30/10/92
The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A1- 3621178	88-01-07	NONE	
US-A- 4761124	88-08-02	EP-A-B- 0257029	88-03-02
		JP-T- 62502278	87-09-03
		SE-B- 463829	91-01-28
		SE-A- 8501280	86-09-16
		WO-A- 86/05555	86-09-25
US-A- 4846642	89-07-11	DE-A- 3712354	88-05-11
		EP-A-B- 0267559	88-05-18
		JP-A- 63179192	88-07-23